

App. No. 09/760,212

Reply to Office action of March 31, 2004

Amendments to the Claims:

32. (currently amended) An apparatus capable of providing both pacing pulses and defibrillation pulses to a patient, the apparatus comprising:

a transfer circuit for externally transferring energy to the patient; and

an energy storage capacitor electrically coupled to the transfer circuit; and

a controller coupled to the transfer circuit that causes the transfer circuit to externally transfer energy from the energy storage capacitor in a defibrillation pulse to the patient when defibrillation therapy is appropriate, and causes the transfer circuit to externally transfer energy from the energy storage capacitor in a pacing pulse to the patient when pacing therapy is appropriate.

33. (previously presented) A circuit that generates a defibrillation pulse in a defibrillation mode and a pacing pulse in a pacing mode, the circuit comprising:

an energy storage capacitor;

a charging circuit coupled to the energy storage capacitor, wherein the charging circuit is configured to charge the energy storage capacitor;

an energy transfer circuit coupled to the energy storage capacitor, the energy transfer circuit having a first output lead and a second output lead, wherein the energy transfer circuit is configured to selectively electrically couple the energy storage capacitor to the first and second output leads; and

a control circuit coupled to the charging circuit and the energy transfer circuit, wherein the control circuit is configured to cause the charging circuit to charge the energy storage capacitor to a predetermined level and, when the energy storage capacitor is charged, to control the energy transfer circuit to couple the energy storage capacitor to the first and second output leads of the energy transfer circuit so that the energy transfer circuit provides:

during the defibrillation mode, an external defibrillation pulse at the first and second output leads using energy stored in the energy storage capacitor, and

during the pacing mode, an external pacing pulse at the first and second output leads using energy stored in the energy storage capacitor.

34. (previously presented) The circuit of Claim 35 wherein the energy transfer circuit comprises four legs, a first leg of the energy transfer circuit including a first IGBT switch circuit and a second, a third and fourth leg of the energy transfer circuit each including an SCR switch circuit.

35. (previously presented) The circuit of Claim 36 wherein the energy transfer circuit comprises a bypass circuit, the bypass circuit being coupled in parallel with the third leg of the energy transfer circuit, and wherein the bypass circuit is configured to provide a conductive path that bypasses the third leg of the energy transfer circuit during the pacing mode and is configured to open circuit the conductive path during the defibrillation mode.

36. (previously presented) The circuit of Claim 37 wherein the defibrillation pulse is selectably provided as a biphasic pulse and the pacing pulse if provided as a monophasic pulse.

37. (previously presented) The circuit of Claim 37 wherein, during the pacing mode, the control circuit is configured to determine the predetermined level in charging the energy storage capacitor to achieve a predetermined current level for a subsequently provide pacing pulse.

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38. (previously presented) The circuit of Claim 36 wherein the H-bridge circuit comprises a current source circuit, the current source circuit being coupled in parallel with the third leg of the energy transfer circuit, and wherein the current source circuit is configured to provide a configurable current to the first output lead during the pacing mode and is configured to provide essentially no current to the first output lead during the defibrillation mode.

39. (previously presented) The circuit of Claim 40 wherein, during the pacing mode, the control circuit is configured to cause the current source circuit to provide the configurable current with a predetermined current level.

40. (previously presented) The circuit of Claim 40 wherein the current source circuit comprises an IGBT and a resistor.

41. (previously presented) The circuit of Claim 35 wherein the energy transfer circuit comprises four legs, a first leg and a second leg, of the energy transfer circuit each including an IGBT switch circuit, and a third leg and a fourth leg of the energy transfer circuit each including an SCR switch circuit.

42. (previously presented) The circuit of Claim 43 wherein the H-bridge circuit comprises a bypass circuit, the bypass circuit being coupled in parallel with the third leg of the energy transfer circuit, and wherein the bypass circuit is configured to provide a conductive path that bypasses the third leg of the energy transfer circuit during the pacing mode and is configured to open circuit the conductive path during the defibrillation mode.

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43. (previously presented) The circuit of Claim 44 wherein the defibrillation pulse is selectably provided as a biphasic pulse having a first phase with a first polarity and a second phase of a second polarity, and wherein the pacing pulse is provided as a monophasic pulse with the second polarity.

44. (previously presented) The circuit of Claim 45 wherein, during the pacing mode, the control circuit is configured to determine the predetermined level in charging the energy storage capacitor to achieve a predetermined current level for a subsequently provided pacing pulse.

45. (previously presented) The circuit of Claim 43 wherein the H-bridge circuit comprises a current source circuit, the current source circuit being coupled in parallel with the third leg of the energy transfer circuit, and wherein the current source circuit is configured to provide a configurable current to the first output lead during the pacing mode and is configured to provide essentially no current to the first output lead during the defibrillation mode.

46. (previously presented) The circuit of Claim 47, wherein, during the pacing mode, the control circuit is configured to cause the current source circuit to provide the configurable current with a predetermined current level.

47. (previously presented) The circuit of Claim 47 wherein the current source circuit comprises an IGBT and a resistor.

48. (previously presented) The circuit of Claim 35 wherein the energy transfer circuit comprises four legs, each of the four legs of the energy transfer circuit including an IGBT switch circuit.

49. (previously presented) The circuit of claim 50 wherein the defibrillation and pacing pulses are selectably provided as a biphasic pulse of monophasic pulse.

50. (previously presented) The circuit of Claim 51 wherein the defibrillation pulse is a biphasic pulse having a first phase with a first polarity and a second phase of a second polarity, and wherein the pacing pulse is a monophasic pulse with the second polarity.

51. (previously presented) The circuit of Claim 51 wherein the defibrillation pulse is a biphasic pulse having a first phase with a first polarity and a second phase of a second polarity and the pacing pulse is a biphasic pulse having a first phase of the second polarity and a second phase of the first polarity.

52. (previously presented) The circuit of Claim 50 wherein, during the pacing mode, the control circuit is configured to determine the predetermined level in charging the energy storage capacitor to achieve a predetermined current level for a subsequently provided pacing pulse.

53. (previously presented) The circuit of Claim 50 wherein the H-bridge circuit comprises a current sense circuit coupled to the energy storage capacitor and the control circuit, and wherein the current sense circuit is configured to detect a current level of current provided by the energy storage capacitor when the circuit is providing a pacing pulse.

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54. (previously presented) The circuit of claim 55 wherein, the during the pacing mode, the control circuit is configured to cause the third and fourth legs of the energy transfer circuit to conduct a predetermined level of current when the circuit is providing a pacing pulse.

55. (previously presented) The circuit of Claim 47 wherein the current sense circuit comprises an amplifier, a transformer and a resistor.

56. (previously presented) The circuit of Claim 35, wherein the energy transfer circuit is configured as an H-bridge.

57. (previously presented) The circuit of Claim 35, wherein the energy storage capacitor is a single capacitor.

58. (previously presented) A method of providing a defibrillation pulse or a pacing pulse to a patient from a single unit, the method comprising:

charging an energy storage capacitor;

during a defibrillation mode, transferring energy from the energy storage capacitor to the patient in an external defibrillation pulse; and

during a pacing mode, transferring an energy from the energy storage capacitor to the patient in an external pacing pulse.

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59. (previously presented) The method of Claim 60 wherein an energy transfer circuit is used to transfer energy from the energy storage capacitor to the patient in both the defibrillation and pacing modes.

60. (previously presented) The method of Claim 60 wherein the energy storage capacitor is charged to a predetermined level so that the pacing pulse has a current of a predetermine level.

61. (previously presented) The method of Claim 60 wherein the pacing pulse is a biphasic pulse.

62. (previously presented) An apparatus for providing to a patient a defibrillation pulse during a defibrillation mode and a pacing pulse during a pacing mode, the apparatus comprising:

an energy storage capacitor;

a charging circuit for charging the energy storage capacitor;

switch means coupled to the energy storage capacitor for selectively transferring energy from the energy storage capacitor to the patient externally; and

control means for causing the switch means to transfer energy from the energy storage capacitor to the patient externally in a defibrillation pulse during the defibrillation mode, and for transferring energy from the energy storage capacitor to the patient externally in a pacing pulse during the pacing mode.

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63. (previously presented) The apparatus of Claim 64 wherein the switch means comprises an energy transfer circuit, wherein the energy transfer circuit is selectively configurable to transfer energy from the energy storage capacitor to the patient in both the defibrillation and pacing modes.

64. (previously presented) The apparatus of Claim 64 wherein the control means is configured to cause the charging circuit to charge the energy storage capacitor to a predetermined level wherein the pacing pulse has a current of a predetermined level.

65. (previously presented) The apparatus of Claim 64 wherein the pacing pulse is a biphasic pulse.